

Highway Performance Monitoring System (HPMS)

FHWA Review Guidelines

CY 2013

Introduction

The Highway Performance Monitoring System (HPMS) was developed as a systematic measure encompassing the scope, condition, performance, use, and operating characteristics of the Nation's highways. It is a national transportation information system and is reflective of all public roads.

One of the most significant and visible uses of information submitted through HPMS is for the apportionment of Federal-aid Highway Program funds to the States as currently legislated. The HPMS also serves as a primary input mechanism for the biennial Condition and Performance Reports to Congress, which supports the development and evaluation of the FHWA's legislative, program, and budget planning. Additionally, HPMS serves as a primary resource for assessing highway system performance under FHWA's strategic planning process; safety measures in terms of fatalities and injury crashes are benchmarked to VMT, pavement roughness measured in IRI, and changes in congestion levels to estimate system delay.

In addition, the HPMS serves the needs of the States, MPOs, local agencies, and other customers in assessing highway condition, system performance, air quality trends, and future investment requirements. Many States, MPO's, and local governments rely on traffic and travel data from the HPMS to conduct air quality analyses to determine air quality conformity and to assess highway investment needs using Highway Economic Requirements System - State Version (HERS-ST) or other similar analytic software. Finally, this information is an invaluable source of information for FHWA's annual Highway Statistics and other media publications. As a result of all these applications, States have an additional interest to maintain and assure timely, complete, and high quality data.

FHWA receives, processes, analyzes, disseminates, and uses information provided by the States through HPMS. The data States provide though HPMS is considered their data, not FHWA's. The quality and integrity of these data rest with the States and are dependent on their processes and procedures used to collect and create the basic data inputs. The questions, concerns, and criticisms that come from the varied information customers reflect directly on the States' ability to accurately portray the condition and performance of their highway systems. FHWA provides guidance, training, and technical assistance to States and must assure that they provide quality data.

The Division Office provides an invaluable stewardship and oversight role in the collection, processing, and submittal of the HPMS data. They have a stake in assuring that data provided by the State is of the highest quality sufficient for FHWA business needs, accurately represents conditions in their State, and was collected and reported correctly. Furthermore, measuring how well the federal-aid program is allocating resources in each State, assuring that each State receives its fair share of federal funds, and assuring that the investment needs of each State are accurately portrayed to the Nation's leadership is an important responsibility that involves the Division Office. This implies that the Division must partner with their State to assure that the data provided are the product of a comprehensive, effectively managed, and adequately funded data collection and reporting process and the data provided to FHWA is timely, complete, accurate and of good quality.

FHWA headquarters provides an overall coordination role in the HPMS process. Reporting standards are set out in the *HPMS Field Manual* and reporting software has been developed and provided to the States. Technical assistance, guidance, and training are regularly provided to Division Offices and the States and data are reviewed against prior year reports, normative trends, and other States to identify possible improvement areas. However, no amount of headquarters review can make up for an informed and comprehensive review by the State data

owners and the FHWA Division Office stakeholders of both the data and the business processes by which the data are produced.

Purpose

These guidelines serve to provide direction and focus on productive and meaningful review activities for the Division Office to use in performing their annual reviews, identifying and prioritizing improvements, and preparing reports documenting findings and recommendations. The guidelines contain specific information on annual reporting requirements, review of program activity areas identified using a program assessment matrix, and detail guidelines for use in conducting program and process reviews of the more significant data collection activities covered by the HPMS.

The guidelines provide flexibility for the Division Office to decide which data areas to focus on to improve the quality of the State's HPMS program. Each Division is responsible for developing, prioritizing, conducting, and reporting on appropriate data program and process review activities. These guidelines should assist the Division in deciding the priority of process reviews to be conducted to ensure that all identified high priority data issues are thoroughly resolved as part of our ongoing data quality initiatives. They also provide detail questions and assessment criteria covering the data reporting areas considered to be of the highest priority for assuring quality data in HPMS. Technical assistance from the FHWA Resource Centers and Headquarters is available and should be considered as needs arise.

General

The FHWA Division Office also shares in the overall responsibility of providing quality data in HPMS. There are many activities that the Division can undertake throughout the year to support the State's program to provide timely and quality data in HPMS. In addition to maintaining a rapport and partnership effort, some of these activities include:

1. Providing technical/training assistance to the State and other agencies providing data
2. Assuring sufficient resources for program and process improvements.
3. Assisting the State in jointly identifying improvements and developing an action plan addressing deficiencies, program enhancements, and efficiencies.
4. Performing annual reviews.
5. Preparing and submitting review reports to Headquarters.
6. Submitting an annual certification on acceptability of the State's data for FHWA's business needs.
7. Acting as a liaison between Headquarters and the State in promoting, coordinating, and reporting on improvements. This includes an annual conference call with Headquarters concerning initial review comment and general program status/concerns
8. Promoting and supporting the numerous uses of data in HPMS.
9. Attend the annual Highway Information seminar (HIS)

Annual Review (by Division HPMS Coordinator) Due December 15th.

The annual review of the HPMS program by each Division Office includes four components: (1) Status Report and Certification, (2) HPMS Program Activity Assessment, (3) documentation and discussion of review activities identified through either the status report or program assessment and (4) annual reporting. These are discussed further in the following sections.

1. Status Report and Certification

This is a summary of activities and actions that have been completed within the past year by the Division Office and the State to be documented on the “FHWA Division Office HPMS Review – Status Report & Certification” form. Additional information as appropriate should be provided to further explain the summary information noted. The references to the review reports available on the HPMS web site can be used to aid in responding to specific data item quality issues. The response to Headquarters submittal comments is only one entry on this form, a reply is encouraged shortly after receipt of comments, and should not be the extent of the Division’s review. The bottom of the form includes the annual certification statement that we ask the Division Administrator (or his delegate) to sign. Please note that this statement includes all data in HPMS used for the major business needs of FHWA and refers to more than just the acceptance of mileage and travel data for apportionment of Federal funds.

2. HPMS Program Activity Assessment

This matrix identifies the major activity areas that are also included on the Status Report & Certification form that serves as a risk assessment of the State’s HPMS program. This form “HPMS Program Activity Assessment” should be completed based on the Division’s knowledge of the State’s program and review of the reports referenced for each data item in the activity column. It focuses on the quality of the data submitted, referring to Headquarters review comments, the data presented in the referenced reports, and Division review activities the past four years. It should not be viewed as an evaluation of the State’s program but as an aid in identifying which areas may need further attention where improvements may be realized. The rating information should be used to identify and prioritize activities for further review.

It may be advantageous to jointly complete this form with the State to provide a more accurate assessment, especially if the Division Office staff is new to HPMS, and to provide valuable information to the State. This assessment may help the State maintain or secure additional resources to address the issues identified to improve their HPMS program. It can provide useful information when discussing the State’s program to support those areas that the Division has determined need further review and possible improvement. An activity producing quality data may still be improved for efficiency even though no major data issues are evident in FHWA’s review and edits of the data. Program efficiencies and enhancements can more easily be identified if a thorough review is conducted on the recommended three year cycle. A periodic review would be beneficial to both the FHWA and the State considering the advances in technology for data collection and processing, frequent staff changes without complete State HPMS program documentation, and limited or reduced resources to provide the same level of detail and extent of data collection.

The seven high priority activity areas are listed below with additional guidance on reviewing each area available in the Attachments:

- Data Submittal (complete & timely)
- SPR Work Program
- Quality Assurance
- GIS/LRS data
- Traffic Data
- Pavement Data
- Sample Adequacy

It is recommended that process reviews be conducted on these high priority areas on a 3-year cycle unless a schedule for improvement or change has been developed and is being implemented or if any major deficiencies are identified that need timely resolution. An initial review may be necessary to establish a base line for these activities, which later can be addressed individually or scheduled over several years. These reviews should not focus on just the comments provided by Headquarters which is a separate activity frequently requiring more immediate discussion, resolution, response, or resubmittal of data.

Most of these priority areas are a continuation of prior review guidelines focusing on those areas that will provide the most effective use of Division Office resources to maintain and enhance data quality. The quality assurance activity addresses the past reviews of actual visual on site field reviews of individual data items on sample sections, the submittal software “Validation Summary Report”, and the State’s quality assurance program. The data collection activities on off-state system facilities are included with each of the activity areas rather than listed separately. The highway capacity data and VMT review items are included under Traffic Data. The review of traffic data should focus on the State’s data collection program and the process for updated current year traffic data in HPMS; review of HPMS traffic data is a key component to determine acceptability of the data submitted. The review and documentation of the State’s Traffic Monitoring Program for Highways (TMS/H) is only one component of the traffic review and should not be the only activity reviewed as discussed further in the Attachments.

The scheduling of process reviews for high priority areas should be determined by the Division in concert with the State based upon the ranking of activity areas and considering those that have the greatest need for improvement. Assistance in conducting process reviews can be provided by Headquarters, the FHWA Resource Centers, Division Office program specialists (pavements, traffic, ITS), and other States as a review team approach. The teaming of FHWA and State resources is a way to foster knowledge sharing, to use available expertise for thorough and comprehensive reviews, and for effective monitoring of improvements.

3. Documentation and Discussion of Review Activities

Review activities undertaken the past year by the Division identified through either the Status Report or Certification or the HPMS Program Activity Assessment should be documented and provided for Headquarters information. This provides valuable information on Division review efforts and further explanation about the State’s HPMS and data collection programs. This can include discussion of comments on the Status Report and Activity Assessment forms, status of process reviews either initiated or completed, and other relevant data collection information. The level of detail is determined by the Division and can range from summary information to detail reviews, guidelines, schedules, team charters, work plans, action plans, and resource commitments.

4. Annual Reporting

The Division Office is responsible for providing an annual certification and supplementary information on their annual review which should be officially transmitted to Headquarters (HPInfoMail electronic mailbox) by December 15th of each year. This information shall consist of the above discussed three areas: Status Report and Certification, HPMS Program Activity Assessment, and documentation and discussion of review activities completed during the past year.

The review memorandum or supplementary information should also document any FHWA actions taken or recommendations made as a result of the review and steps the State is taking to make HPMS program improvements. Follow up reporting by the Division of issues, recommendations and results on a year-to-year basis are essential to staying on the path to quality improvement over time. And, in an era of rapidly changing staff and responsibilities, it is important to maintain an adequate record of progress.

Additional Considerations

It is important that reviews be performed in a timely manner so that results and recommendations can be implemented before the State starts their next data submittal. This provides time for further discussion with Headquarters and for the State to improve processes or data collection efforts if needed. Starting a review early in the year allows for sufficient time for discussion and if necessary adjusting resources and priorities in developing the next SPR Work Program; sufficient information is available without waiting for the current year data submittal or review comments from Headquarters. The Division's review activities can be included in the Division's annual work plan and review schedule for the coming year to make sure all participants are identified and available.

Data, review comments, and identification of issues are readily available to the Division and State even before Headquarters current year review comments are transmitted. This information includes past Headquarters review comments, State's submittal comments, validation summary reports from the HPMS software, HPMS website tables and reports, Division knowledge of the State's HPMS and data programs, and frequent SPR work program progress and performance reports.

Whenever a review is performed, the Division must address adequacy of funding for the HPMS program for both the State and Metropolitan Planning Organizations (MPOs) providing data. The adequacy of personnel, equipment, and training needed by State and local agencies to conduct the HPMS program in a quality manner should be examined by the Division. Resolution of high priority data issues should be a factor in determining priorities for funding of activities in State Planning and Research (SPR) and Unified Planning Work Programs (UPWP).

With the release of the HPMS 8.0, spatially enabled web-based software tools have been provided to examine the quality of data submitted by the States. The Divisions are encouraged to become skilled with the HPMS software to facilitate the reviewing of their State's data and for conducting process reviews of critical data areas. The Divisions should make full use of the HPMS Field Manual, resource information on the HPMS web site, and examples of other Divisions' outstanding reviews as a resource when developing and coordinating data and process reviews.

Quality Data an Important FHWA Agency Objective

Information and Analysis is a key criterion which FHWA uses as a measure of our agency's performance to determine if we are meeting the needs of our customers, States, Congress, and the public in providing quality data which accurately represent the travel characteristics and extent of our Nation's highway system. How we effectively manage the quality of data in HPMS has a direct impact on FHWA's ability to assess our progress in meeting agency performance objectives for the Strategic and Annual Performance plans. The proactive assistance of the Divisions and Resource Centers in working with the States and MPOs on improving the quality of data in HPMS should be a critical component of planned Division and Resource Center work activities. Improving data and processes for HPMS should be included in the Division's performance plan objectives and self assessments and should be accomplished by working with the State DOTs and MPOs. We encourage the teaming of Division, Resource Center, Headquarters and State staff to maintain and improve the quality of data in HPMS, and to provide an opportunity for knowledge sharing as part of meeting our agency goals of developing high quality highway information for our customers. With the implementation of the HPMS 2010+ system, a fundamental change in HPMS has taken place. Geospatially enabling HPMS gives us another way to review the system. Samples as well as all sections can now be seen and at the reviewer's option, review the data while still in the office.

(State name) FHWA Division Office HPMS Review - Status Report & Certification

(Annually by December 15th, complete and sign this form, the risk assessment, and attach additional information as necessary.)

STATUS REPORT – Answers (Y/N) to these questions should be reflected in rating each activity on the HPMS Program Activity Risk Assessment form.

Geographical Information System (GIS)/Linear Referencing System (LRS) Adequacy

- _____ State maintains an accurate up to date, as driven GIS/LRS
- _____ The LRS/GIS represents and correlates with the State's Enterprise Management Systems
- _____ Federally-Aided Routes are included
- _____ All Public Roads are included (optional)

Data Submittal

- _____ State completed their data submittal by June 15 with no major deficiencies
- _____ State's submittal letter adequately explains recurring conditions, edits, changes, and improvements being made in data collection procedures and processing data?

Highway Policy Information (HPPI) memo to Division Office concerning current year HPMS submittal

- _____ The memo been fully discussed and understood by both the Division and State?
Date response forwarded to OHPI including discussion of implementation _____
Resolution of other comments in correspondence and discussions _____

SPR Work Program

- _____ Current levels of SPR funding are adequate.
- _____ State has requested additional resources for data collection, system improvement or staffing
- _____ Process improvements identified, reflected in an action plan, and fully supported in SPR or State work programs

Quality Assurance

- _____ The State has a quality assurance program concerning all data provided for HPMS
- _____ The data reported in HPMS directly reflect current enterprise information systems
- _____ A Field Inventory Review has been conducted within the past year to verify data is coded properly and reflects current conditions and all problems/issues have been rectified.

Traffic Data

- _____ Have all the necessary counts taken place on the Federal-Aid System to accurately represent traffic volume for the data year, per the TMG? Do traffic volume trends reasonably reflect ATR data?
- _____ Do the trends in VMT by functional class appear reasonable compared to adjoining functional class groups and prior year's data?
When was the last time your office did a process review of the State's traffic monitoring program to assure that procedures are adequate and are being applied to all data for HPMS? (This is more than just the TMS/H review; it should follow the guidelines in Attachments D and E.) _____

Pavement Data

- _____ IRI data been provided and updated within the last 1 or 2 years as required
- _____ When was the last time your office did a process review of the State's pavement data program to assure that procedures are adequate and are being applied to all data for HPMS? _____
- _____ Is the State maintaining the locational integrity of pavement data over time?

Sample Adequacy

- _____ The State conducted a sample adequacy review this year; explaining results and changes in number of samples or when last review was conducted.
When was the last time your office did a process review of sample adequacy to assure that procedures are adequate and are being applied to all data for HPMS? _____

The following apportionment factors for the Federal-Aid Highway Program are derived from HPMS. They can be found in the HPMS 8.0 software, *Extent and Travel Report*. Please verify this information and enter it below. Each FHWA Division must certify that this information as reported in HPMS is accurate and verified.

FC = Functional Classification

Apportionment Factors:

Interstate Principal Arterial, FC = 1

Lane-miles:_____

Annual VMT:_____

Non-Interstate Principal Arterial FC =2, 3

Lane-miles:_____

Annual VMT:_____

Principal Arterial FC = 1, 2, 3

Lane-miles:_____

Federal-aid Highway FC = 1, 2, 3, 4, 5, Urban 6

Lane-miles:_____

Annual VMT:_____

ANNUAL CERTIFICATION

I certify that the State's HPMS submittal and the information in this review are true and correct to the best of my knowledge and belief and there is no evidence of submission of false data, which would be in violation of U.S.C., Title 18, Section 1020. Furthermore, I certify that this data is valid and suitable for use in the apportionment of Federal-aid highway funds, performance measurement, and condition and performance reporting to Congress.

FHWA Division Administrator

Date

----- HPMS Program Activity Assessment -----

Activity	Poor 0 point	Fair 5 points	Good 10 points	Outstanding 20 points	Score (points)
GIS/LRS Adequacy	GIS/LRS is not maintained and/or does not reflect the entire Federal Aid System	GIS/LRS is maintained and does reflect the entire Federal Aid System. May not be integrated with the DOT Enterprise or completely up to date	GIS/LRS is maintained and does reflect the entire Federal Aid System. It is integrated with the DOT enterprise but may not be completely up to date.	GIS/LRS is maintained and does reflect the entire Federal Aid System. It is integrated with the DOT enterprise and is completely up to date.	
Data Submittal	Late with complete mileage and VMT data, other major data issues not explained	By June 15 th , complete mileage & VMT data, major issues explained or data resubmittal	By June 15 th , complete data and minor comments	By June 15 th , no comments	
	Submittal letter brief and general comments	Submittal letter explains only recurring comments	Submittal letter explains recurring comments and edits	Submittal letter explains recurring comments, edits, and changes in procedures and processes	
SPR Work Program or State Planning Work Program	Decrease or inadequate funding or no priorities for data collection including staff, training or equipment	Adequate funding, some recognition of needs and new activities, but still no changes in staff, training, or equipment	Adequate or increased funding, more staff and training for selected activities	Adequate or increased funding for process review (or action plan) recommendations included in work program	
Quality Assurance	Minimal quality assurance, off-state system issues, many coding error messages	Basic quality assurance program for short term solutions including off-state system issues, some coding error messages explained in submittal letter	Quality assurance program implemented and coordinated with all data providers, minor isolated problems,	Quality assurance program documented, funded, and no major data coding problems found	
Traffic Data	Current year data provided with non statistical or non verifiable explanation for anomalies and unusual trends for F.C. or H.V. locations, Primary OHPI comments.	Current year data provided for all PAS, acceptable statistical justification for anomalies and unusual trends for F.C. or H.V. locations, Primary OHPI comments.	Current year data provided for all F.C., acceptable statistical justification for anomalies and unusual trends for F.C. or H.V. locations, Secondary OHPI comments.	Current year data provided for all F.C., no unusual trends by F.C. or H.V. locations, no OHPI comments.	
Pavement Data	Complete data provided on-state system updated on an infrequent cycle, off-state system data incomplete, Primary OHPI comments	Complete data provided on-state system updated on a 2 year cycle, plan developed for complete off-state system data, Primary OHPI comments	Complete data provided and collected with supporting explanations that differ from Field Manual, all current 1-2 year data, Secondary OHPI comments	Complete data provided and collected in accordance with Field Manual, all current 1-2 year data, no OHPI comments	
Sample Adequacy	Sample revisions needed, identified, but not made. Primary OHPI comments	Some sample revisions were made, sample adequacy assessed. Primary OHPI comments	Most sample revisions were made, sample adequacy assessed. Secondary OHPI comments	Sample revisions not needed or were made addressing all deficiencies and OHPI comments	
Total Score (140 max)					
Activity(s) Identified for Review: (Less than 10, more than one activity should be considered)					

Guidance for completing the HPMS Program Activity Assessment

The activity with the lowest points should be considered for further review following the guidelines in the Attachments. If scores are similar to prior year's assessments, history of continuing issues, or OHPI comments should be considered in selecting activities for your further review.

The Report references are on the FHWA HPMS web site for each State

<http://www.fhwa.dot.gov/policyinformation/hpms.cfm> Attachment A provides guidance on how to access these reports.

The Attachments C through H provide guidance on reviewing each activity in detail that may need to be tailored and customized to adequately support a comprehensive process review addressing the particular issue or program area.

Acronyms used in Risk Assessment Form:

FC	Functional Classification
Field Manual	HPMS Field Manual
H.V.	High Volume (AADT)
OHPI	Office of Highway Policy Information
PAS	Principal Arterial System
SPR	Statewide Planning and Research program
VMT	Vehicle Miles Traveled

Summary of Attachments, Resources, and References

Attachments:

- A. Data Submittal Comments
- B. SPR Work Program Review Guidelines
- C. Quality Assurance Review Guidelines
- D. Traffic Data Review Guidelines
- E. Review of Traffic Data Submitted for HPMS
- F. Pavement Data Review Guidelines
- G. Sample Adequacy Review Guidelines
- H. Geographical Information System (GIS)/ Linear Referencing System (LRS) Reviews

Resources:

- 1. Office of Highway Policy Information Web Site
<http://www.fhwa.dot.gov/policyinformation/index.cfm>
- 2. HPMS Web Site
<http://www.fhwa.dot.gov/policyinformation/hpms.cfm>
- 3. [Overview of Highway Performance Monitoring System \(HPMS\) for FHWA Field Offices, HPMS Primer](#)
- 4. [HPMS Community of Practice, Web Site](#)
- 5. [HPMS Sample Management](#)
- 6. [State Procedures for Developing K-factors, D-factors, and Percent Trucks](#)
- 7. [State Practices Used to Report Local Area Travel](#)
- 8. [HPMS Traffic Data for High Volume Routes: Best Practices and Guidelines, September 2004. Available from Office of Highway Policy Information](#)

[HPMS Resources and Publications, Web Site](#)
 - a. [HPMS Frequently Asked Questions and Answers](#)

References:

- 1. HPMS Field Manual, FHWA
<http://www.fhwa.dot.gov/policy/ohpi/hpms/fieldmanual/>
- 2. 2008 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance Report to Congress
<http://www.fhwa.dot.gov/policy/2008cpr/index.htm>
- 3. Highway Statistics, 1992 to Current Year
<http://www.fhwa.dot.gov/policy/ohpi/hss/hsspubs.cfm>
- 4. Traffic Monitoring Guide (TMG)
<http://www.fhwa.dot.gov/ohim/tmguid/index.htm>
- 5. Title 23 USC - Highways, Chapter 5 - Research and Technology,

Sec. 502. Surface transportation research, (g) Infrastructure Investment Needs Report
<http://frwebgate.access.gpo.gov/23USC502>

6. Title 23 CFR - Highways, Part 420 - Planning and Research Program Administration,
Subpart A - Administration of FHWA Planning and Research Funds
420.105.1 What is the FHWA's policy on use of FHWA planning and research funds?
<http://ecfr.gpoaccess.gov/cgi/t/text/23:1.0.1.5.10.1.1.3>

Attachment A: Data Submittal Comments

The HPMS Submittal Comments are entered under the Submit Data tab in the HPMS 8.x software. The purposes of the comments are to explain data issues, problems, deficiencies, unusual conditions, and any significant changes from the previous HPMS submittal.

The Submittal Comments are intended to address recurring or new issues on unique conditions in the State, problems, deficiencies, program and process changes, future activities proposed to improve data quality, and significant changes from the previous HPMS submittal. Does that State address these issues and are there other activities that should have been discussed? Specific issues that can also be addressed in this file are the following:

Explanation of software messages, errors and that the State feels is correct or needs further explanation

Issues and processes affecting the data for HPMS and its quality

FHWA Headquarters comments on last year's data submittal

Discussion and listing of sample revisions, deletions and additions

IRI/Pavement data collection procedures

Traffic monitoring activities and procedures (Truth in Data Narrative)

Urban boundary and functional class changes

Comments on reports on FHWA web site

Mileage reporting for certified mileage, system changes, and Federal lands

Summary data of population and net land area

Comments on full extent data items

Override of peak capacity values

Pictures of unusual or unique roadway conditions

Identifying HPMS and other State contacts

Attachment B: SPR Work Program Review Guidelines

As part of an in-depth review of the SPR (Statewide Planning and Research) Work Program, activities that could be investigated and comment on include the following:

Descriptions & Resources

1. Does the current year program have sufficient resources allocated to HPMS and data collection? This would include data collection equipment, computer software and hardware, training, travel, and participation in FHWA workshops. Are these activities described in the program? Does the description accurately represent tasks that are underway today or proposed for future years?
2. Is there adequate staffing available for HPMS and data collection programs?
3. Are there consultants involved in data collection or reporting of HPMS data items?
4. Do the Metropolitan Planning Organizations (MPOs) collect data and is it described in either the SPR or PL work programs? Is there a formal agreement, memorandum of understanding, or guidelines provided specifically for their use, are they accountable?

Funding

1. What is the budget amount for HPMS in the SPR or State planning work programs? This would be the principal staff or those associated with the annual HPMS submittal and not necessarily those involved in data collection. What is the consistency of the current funding level for the past several years? Is funding expected to increase?
2. Are there SPR, PL or Safety Funds used for MPO data collection activities supporting HPMS? What are these funding levels?
3. Does the State supplement the SPR work program with State only funds? Describe these activities, the funding levels, and your involvement in monitoring and supporting them.
4. Do expenditures track closely with programmed funds? If not, what is being done to emphasize the need for resources to be expended on these activities?
5. Do large unobligated balances of funds exist? Some of these may be saved for next year's program. Are all data collection programs and activities to support Title 23, USC, Sec 502 being adequately addressed?
6. What is being done to increase funding for data collection improvements if deficiencies in these programs have been identified?

Improvements & Recommendations

1. Have past comments from OHPI been discussed in the development of the work program and have changes resulted in the program to support these comments?
2. Are comments and recommendations presented in writing to the State on the draft program or in the approval of the final program?

3. Are recommendations from process type reviews and action plans reflected in the SPR work program?
4. Are improvements or future HPMS and data collection review activities discussed?

Program Oversight & Monitoring

1. Is there formal correspondence to the State on approval of SPR Work Program? Comments could be made on high priority activities, acknowledgement of successful efforts, and offering support.
2. Describe the monitoring activities of the Division to assure that funds programmed are being spent accordingly. Are their progress meetings periodically throughout the year? Does the planning staff review final expenditure and performance reports before the project is closed out or before next years program is developed and or approved? How is the program monitored: quarterly, periodically, frequent meetings, reviewing billings?

References

Title 23 USC - Highways, Chapter 5 - Research and Technology,
Sec. 502. Surface transportation research, (g) Infrastructure Investment Needs Report
<http://frwebgate.access.gpo.gov/23USC502>

Title 23 CFR - Highways, Part 420 - Planning and Research Program Administration,
Subpart A - Administration of FHWA Planning and Research Funds
420.105.2 What is the FHWA's policy on use of FHWA planning and research funds?
<http://ecfr.gpoaccess.gov/cgi/t/text/23:1.0.1.5.10.1.1.3>

Attachment C: Quality Assurance Review Guidelines

A quality assurance program can assist the State in continually providing quality data for the HPMS submittal. This program generally consists of various activities used to verify that data in the State's database and subsequently data in HPMS are accurate, current, and representative of the State's highway system. This program can also rely on the Division Office Field Reviews to spot check coding of various data items by physical observation or other methods. To assess quality assurance of data in HPMS the following three activities should be reviewed:

Validation Summary Report

1. Does the Validation Summary Report contain many errors?
2. Has adequate justification and explanation been provided for these errors in the State's submittal letter?
3. Are there continuing errors that require a change in procedures or processes?
4. What progress has been made in addressing these error messages?
5. Are there fewer messages each year?
6. What is being done to eliminate these messages?

Quality Control Program

1. What are the State's management goals and philosophy for quality data? This should be more than just editing data and can include such activities as sharing, partnering, cost, duplication, and coordination.
2. Does the State have a quality control program and what are the basic components of the program?
3. How current is the program and when was the last time it was updated?
4. Is it thoroughly documented? Please attached or provide a link to the documentation.
5. Is it a sampling plan and does it include statistical accuracy, confidence levels, and annual monitoring and reporting?
6. Does it show or document that data quality has been improving?
7. How are training, follow up, and monitoring of the quality control program accomplished to make sure it is effective and still useful?
8. Are the HPMS software edit routines used or are there other data edits and comparisons?
9. Does it apply to just data for HPMS or to all data in the State's database?
10. Describe how it improves HPMS quality?
11. Does it include off-state system data collected by other agencies? If not, what assurance is made of the quality of this data reported by others? What feedback and assistance is provided other agencies?

12. Describe the FHWA Division Office involvement in the State's quality assurance program? This can include submittal procedures, computer hardware and software activities, monitoring equipment maintenance and updating, resource needs, and data integration programs.

Field Inventory Review

A Field Inventory Review should consist of on site visits of randomly selected section locations (The HPMS Software will provide a tool to do this) to verify that the data reported represents current conditions and is accurately coded in the State's most recent HPMS submittal. This is most effective if conducted jointly with the State to add credibility to the findings and to discuss conditions and interpretations as they occur in the field. The HPMS training materials or web site can be used as guidance in the proper coding of data items.

A check should be made on a minimum of 30 sample and 30 full extents sections divided evenly between Interstate, Non-Interstate NHS, and other arterial and collector systems. All visible section information should be verified and the State should provide evidence of non-visible data items. Both field visits and remote sensing should be used in the review of the roadways.

The findings should be discussed and presented to the State to determine if procedure changes are necessary for the collection, processing, or coding of specific data items. Discuss responses to your findings and what actions will be taken for resolution.

Verification that changes have been made may need to be performed on an ongoing basis and reported to HQ.

The findings of the field review may result in changes in the State's quality assurance program. This can also be viewed as a review of the State's quality assurance program (assuming they have one) to verify that it is working and if improvements are needed. Discuss how this has improved the quality assurance program.

Attachment D: Traffic Data Review Guidelines

The review of traffic data could focus on several traffic monitoring activities, which affect many data items. These activities include the traffic monitoring program, travel data (VMT), and highway capacity related data.

To assist in determining which traffic activities to review, other than those issues and comments highlighted in the past, it is suggested that periodically a detail review of the AADTs reported in the State's submittal should be made. The Attachment E flowchart "Review of Traffic Data Submitted for HPMS" should aid in this review to determine if AADTs were calculated properly using the State's procedures and meeting the requirements of HPMS. The accompanying narrative to this flowchart should supplement and further describe many elements of the State's traffic monitoring program as presented in this attachment.

Traffic Monitoring Program

A. Status of Traffic Monitoring System for Highways

Has the Traffic Monitoring System for Highways (TMS/H) ([23 CFR 500 Subpart B](#)) program been thoroughly documented and accepted by FHWA? Comment on recent updates and future improvements being considered.

B. Continuous Count Program

1. How many ATRs (Automatic Traffic Recorders), urban and rural, are in use?
2. What seasonal pattern groups are developed and how many ATRs are there for each group? Does each group meet the 10 percent precision and 95 percent confidence level?
3. To the extent possible, is there one ATR on each route of the PAS/NHS?
4. Are there at least 3 ATRs on both the rural and urban non-Principal Arterial routes?
5. For each ATR, is a minimum of 7 full days of data for each day of the week for each month collected?
6. How many ATRs in the system (urban/rural) are used for the development of adjustment factors?
7. Manufacturer's names of ATR systems (sensors and recorders) being used?
8. What accuracy checks are made of the ATR setups and the data being collected?
9. Describe the State's processing of ATR data, including editing procedures, automation and software, and missing data procedures.
10. Do MPOs, TMC's or other agencies have a continuous count program? Describe the content and extent of this program and how it is used by the agency and State.

C. Coverage Count Program (some of these areas are covered in HPMS 8.0 Metadata, Division should verify)

1. Which roadways are included in the State's coverage count program?

2. Does the State's coverage count program cover the entire NHS and all functional classes above collector?
3. Are the State's traffic volume counts made on at least one third of the HPMS sample panel by functional class each year? Are the rest of the locations counted on a 6-year cycle?
4. Is the duration of all traffic volume counts a minimum of 48 hours?
5. How many 48 hour traffic volume counts are conducted by the State each year off the State highway system (urban/rural)? Are there at least one-third of the total counts required on a three-year cycle?
6. What traffic volume counting equipment systems are used by the State? What checks are made of the equipment?
7. Does the State include traffic counts collected by MPOs, ITS, local agencies and contractors? What is the schedule for these counts? How are they factored?
8. What procedures and controls are required for traffic counts collected by MPOs and others? Are these procedures and controls consistent with the TMS/H requirements?
9. What coordination is done with local agencies to ensure satisfactory procedures are used?
10. What procedures and controls are specified for the collection of coverage counts by contractors?
11. If ITS or freeway monitoring system data is being used, what is the process of verification, calculating AADTs, and quality control?
12. To determine if AADTs were calculated properly using the State's procedures and meeting the requirements of HPMS, a review should be made on a random sample of HPMS sections using the flowchart "Review of Traffic Data Submitted for HPMS" in Attachment E.
13. Describe the process used by the State to update traffic volume data for each HPMS submittal using all available State and other agency data.
 - a. If the HPMS section does not match exactly with the traffic counting section (in the State's traffic database) how are traffic volumes calculated and assigned to the HPMS section?
 - b. Is this an automated or manual process? Describe this process.

D. Vehicle Classification Program

1. Does the State stratify vehicle classification by type of area (urban/rural) and functional class?
2. Does the State allocate classification sampling to the above noted stratifications in proportion to the associated VMT for these systems?
3. Describe the State's vehicle classification activities in terms of number of counts (urban/rural), duration, and type (automated or manual).
4. How many counts are used to calculate axle correction factors (urban/rural)?

5. Does the State conduct vehicle classification by lane and in both directions?
6. Does the State distribute its vehicle classification sampling throughout the year to avoid the need for seasonal adjustments?
7. Describe the data retrieval and reporting activities and procedures.
8. What counting equipment systems are used? What checks are made of the equipment?
9. Vehicle classification activities on the NHS must be sufficient to assure that on no greater than a 3-year cycle every major system segment will be monitored to provide information on the numbers of:
 - a. Single-trailer combination trucks.
 - b. Multiple-trailer combination trucks.
 - c. Two-axle four-tire vehicles.
 - d. Buses.
 - e. AADT
 - f. Z axle six tire
 - g. Motorcycles

To what extent does the State's classification program fulfill the above requirements?

10. In monitoring vehicle classification on the NHS, if it is determined that two or more continuous major system segments have both similar traffic volumes and vehicle type distributions, a single monitoring session will be sufficient to monitor these multiple segments. Does the State use this single monitoring session approach?
11. What is the State's program for meeting the TMG guidance on 30% of all volume counts being vehicle classification counts?
12. Number of vehicle types 13, 14, and 15? What are 14 and 15 used for if included?
13. What class or truck adjustment factors by season and day of week are used?

E. Adjustment Factors Procedures

1. What factors are used by the State (seasonal, axle, day of week) to adjust coverage counts?
2. Does the State review their adjustment factors annually and update them yearly?
3. Are the State's editing and adjusting procedures for converting short term counts to AADT documented?
4. Describe the State's practices and procedures for developing and applying seasonal adjustment factors.
5. Describe the State's practices and procedures for developing and applying axle adjustment factors.
6. Describe the State's practices and procedures for developing and applying day of the week adjustment factors, yearly adjustment factors.

7. Does the State apply these same adjustment factors to coverage counts provided by MPOs and other agencies? If not, do other agencies apply factors to data collected and what are these factors reviewed and accepted by the State?
8. Documentation of the vehicle classification program should demonstrate that:
 - a. The data is representative of the specific functional class.
 - b. Each season of the year is represented in the development of the axle corrections.
 - c. The monitoring session durations are sufficient to account for the changes in vehicle mix from day to day (at least 48 hour counts).
 - d. The total volume of vehicles observed is at least equal to that for an average day.
 - e. Classification counts adequately represent both rural and urban locations.
 - f. There are sufficient categories to represent vehicles with more than two axles.

Does the State's vehicle classification program satisfy the above requirements?

9. How many classification sites are used to calculate axle correction factors?
10. Describe the State's development and application of growth factors.
 - a. On what basis are growth factors developed?
 - b. Are growth factors used to develop AADTs (except where current-year counts have been taken)?
 - c. How are growth factors developed?

F. Procedures and Activities for Equipment Testing, Documentation, and Data Retention

1. Describe the State's requirements for testing of equipment used to collect traffic data.
 - a. Does the State have documented testing procedures?
 - b. What are the specified frequencies of testing for the various devices?
 - c. What is done when equipment does not pass the specified tests?
 - d. How often is equipment tested and calibrated?
2. Describe the State's documentation of its data collection procedures. Does the documentation specify the following?
 - a. Number of counts.
 - b. Period of monitoring.
 - c. Cycle of monitoring.
 - d. Spatial and temporal distributions of count sites.
3. Describe the State's source data retention.
 - a. Are traffic/travel data (i.e. values, dates, and hours of monitoring) retained until updated?
 - b. Are data retained in formats conforming to the TMG?
4. How often do the State and MPOs update documentation of their traffic monitoring procedures? How current are the existing procedures?

G. Funding and Personnel Support for Traffic Monitoring Program

1. Describe the current funding and staffing of the State's traffic monitoring program(s) and activities. FTE's vs. FTE's/1000 counts

2. Describe future program improvements (ex: additional resources, equipment acquisitions, data processing changes, research activities, additional volume counts/ classification counts/WIM's, etc.).

Travel Data - Vehicle Miles Traveled

Travel is calculated from traffic data and corresponding section lengths entered into the HPMS database. Travel by functional system and specific Interstate routes should be reviewed for significant increases or decreases. Larger than normal changes, based on past trends, should trigger an examination of reasons for the changes and the reasonableness of the reported values. Reviews should address both reported length and traffic data for functional systems and routes examined. Issues to examine include:

1. Is total VMT by functional system reasonable for the reported year and are comparisons to prior years reasonable?
2. Are total rural and total urban VMT data reasonable and are trends consistent?
3. Determine if changes in VMT by functional system reasonably reflect recent annual trends within geographic sub-areas of the State.
4. Is functional system VMT by urbanized area reasonable based upon past trends and are comparisons among urbanized areas reasonable?
5. Compare reported VMT and MPO VMT estimates for consistency at the functional system and/or urbanized area levels.
6. Are HPMS generated VMT used for air quality conformity purposes in non-attainment areas? Are there unresolved issues or problems associated with their use?
7. Can significant changes in VMT trends be justified? Review the adequacy of the documentation supporting these travel changes.
8. Determine how changes in route miles are reported and documented by the State or MPOs or Cities. Do the route mile changes appear reasonable based on past trends? How does the State monitor local government mileage data changes?

Highway Capacity Related Data

Some of the more significant data items which contribute to the quality of highway capacity estimates include: percent trucks, turning lanes, at-grade intersections, percent green time, shoulder type and width, number of peak lanes, lane width, median width, median type, and K (design hour volume) and D (directional) factors. Some issues the Division could examine include:

A. K and D Factors

These factors are generally determined from ATR data. Statewide rural and urban K and D factors applied to all routes or to entire functional systems should only be used as an interim procedure if site-specific data is not available. The use of route specific factors for similar facilities, factors by functional system for individual urban or urbanized areas, or factors by route or functional system for State sub-areas having similar characteristics are acceptable if site-specific data is not available.

1. How often are K and D factors updated by the State and MPOs?

2. What is the process for calculating these data and assigning them to sample sections? Is the process the same for off-state system locations?
3. What are the factors being used and are they reasonable? Comment on the range of factors being used.
4. If improvements are needed in providing more site-specific data, what is the State's scheduled and plan?
5. How are the K&D factors calculated for 48 hour or 7 day counts?

B. Percent Trucks

These percents are generally determined from vehicle classification data and applied to sampled roadway sections. Statewide rural and urban truck percents applied to all routes or to entire functional systems should only be used as an interim procedure if site-specific data is not available. The use of route specific percents for similar facilities (characterized by truck routes, land use, geometrics, or other criteria), percents by functional system for individual urban or urbanized areas, or percents by functional system for State sub-areas having similar economic activities and characteristics are acceptable if site specific data is not available. As the State is further implementing a vehicle classification program following the guidance in the Traffic Monitoring Guide (one third of volume counts should be classification counts) more site-specific data should become available each year.

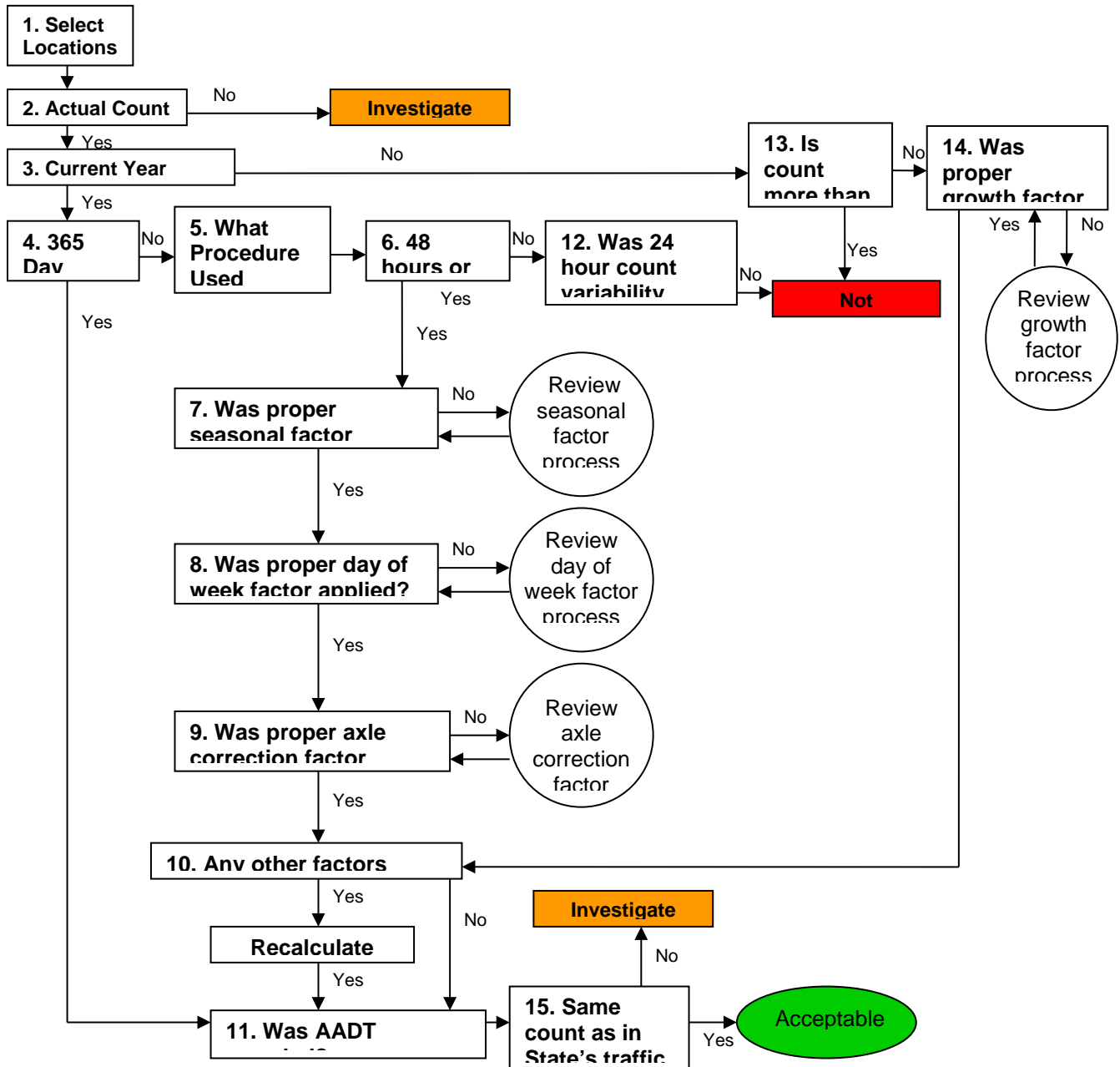
1. How often does the State update percent truck data?
2. What is the process for calculating these data and assigning them to sample sections? Is the process the same for off-state system locations?
3. What are the factors being used and are they reasonable? Comment on the range of factors being used. How is truck data factored?
4. Is this data shared with MPOs and other agencies?
5. What is the State's schedule and program (1, 2 or 3 years) for meeting the vehicle classification program guidance in the Traffic Monitoring Guide?

Reference Documents

- *HPMS Field Manual, Annual Average Daily Traffic*
- *Traffic Monitoring Guide*
- *AASHTO Guidelines for Traffic Data Programs*
- *Traffic Monitoring System, 23 CFR part 500; subpart B*

Attachment E: Review of Traffic Data Submitted for HPMS

(Numbers refer to additional guidance on following



Additional guidance corresponding to numbers on the flowchart.

1. Locations should be selected randomly using some criteria such as: past issues, distribution by functional class, functional class and VMT, high volume locations, on state and off state system, and a minimum of 15 locations. Sample and universe sections should be considered.
2. Was the AADT reported in HPMS based on an actual count taken with traditional traffic monitoring equipment located at the sample location? This would involve reviewing this location in the State's traffic database to see if a count was taken or if it is based on a count from an adjoining roadway section. If a count was not taken, was the AADT based on either of the other two acceptable methods, data from a freeway monitoring system or ramp balancing, which needs to be reviewed to determine acceptability? If the count was based on any other process or information, even if it used that year's data, it is not acceptable for HPMS reporting.
3. Was the AADT based on a traffic count taken the same year as the reporting year for HPMS? Current year data is required to be reported in HPMS; if this is not the case, then proceed to step 12.
4. This is typically referred to as an Automatic Traffic Recorder (ATR), which continuously monitors traffic 365 days a year. If this is not an ATR location, proceed to step 5 to determine the acceptability of shorter counts. A 365 day count is usually the most accurate count available based on continuous monitoring at the site. 365 days is the ideal with many locations oftentimes having some missing data. The amount of missing data needs to be reviewed to assure a minimum of 7 weekday counts each month are available. If there is missing data, how many days or months were missing, and was the count still used? This should be in accordance with State procedures and typically nine months of acceptable data is required to calculate a valid AADT from an ATR count. To calculate an AADT are all days averaged, are monthly ADTs calculated first then averaged, or is some other method used? If days are missing each month, the preferred method is to calculate a monthly ADT first for each month and then average all the monthly ADTs to get an AADT.
5. What Procedure was used to assure that less than 48 hour ADT counts produced adequate results?
6. The minimum counting period for all traffic counts is 48 hours. Lesser time is generally not acceptable unless this process is reviewed in step 11. Is the 48 hour count divided by 2 or is the preferred method of averaging the two 24 hour counts used?
7. For all short term counts (less than an ATR count) a seasonal adjustment factor shall be applied to adjust the count to an annual count based on travel patterns of similar facilities in the State. This factor is developed based on the grouping of ATR locations of similar travel patterns and statistical variability. These are typically factors for each month of the year based on specific groupings unique to your State. Was the proper seasonal factor applied for the month the count was taken as verified from reviewing the State's table of seasonal adjustment factors? If the proper factor was not used or the number doesn't follow the trend from prior years or adjacent months, then an in-depth review of the seasonal factor process should be conducted. The seasonal factor process should be periodically reviewed at least every three years: assistance for this review is available from HPM30 (Traffic Monitoring Division) in the Office of Highway Policy Information. The State should be reviewing this process annually and updating at least every three years.
8. For all counts less than 7 days (less than 168 hours) a day of week factor shall be applied to adjust the count for variations in daily traffic. This factor usually uses the same grouping of ATR locations as the seasonal adjustment factor groups. This factor adjusts the count to considered different travel patterns typically found on week ends (Friday, Saturday, and Sunday) which is not the time period most counts are typically taken. Sometimes the day of week factor is included in the seasonal adjustment factor discussed in step 6; this needs to be verified if separate day of week factors are not being applied. Was the proper day of week factor applied for the days the count was taken as verified from reviewing the

State's table of day of week factors? If the proper factor was not used or the number doesn't follow the trend from prior years or adjacent days or weeks, then an in-depth review of the day of week factor process should be conducted. The day of week factor process should be periodically reviewed at least every three years; assistance for this review is available from HPM30 (Traffic Monitoring Division) in the Office of Highway Policy Information. The State should be reviewing this process annually and updating at least every three years.

9. For all counts taken that monitor vehicle axles an adjustment shall be made to convert axle counts to vehicle counts. Pneumatic road tubes or other sensors that only monitor one axle at a time typically count axles. If the sensors monitor all axles and axle spacings, or record vehicle length whereby the type of vehicle can be determined, then an axle correction factor is not necessary. An axle correction factor is usually developed from vehicle classification information at that location, adjacent roadway section, or for that factor group. Was the proper axle correction factor applied for the axle count taken as verified from reviewing the State's table of axle correction factors? If the proper factor was not used or the number doesn't follow the trend from prior years or adjacent factor groups, then an in-depth review of the axle correction factor process should be conducted. The axle correction factor process should be periodically reviewed at least every three years; assistance for this review is available from HPM30 (Traffic Monitoring Division) in the Office of Highway Policy Information. The State should be reviewing this process annually and updating at least every three years.
10. There shall be no other adjustment factors applied to an actual traffic count than the three described in steps 6, 7, and 8. Any other type of factor is not allowable which may include such things as equipment error, simultaneous vehicle hits on sensors, high or low volume adjustments, engineering judgment, or perceived errors. If any of these other non-allowable types of factor were applied, the AADT should be recalculated without these factors.
11. Was the AADT that was calculated after all adjustments were made rounded so a more general number could be reported? This is an acceptable practice, but not required, provided it is used consistently for all counts. Some States do not round ATR counts just so they can easily identify these counts in their database. Counts rounded for HPMS should also be rounded in the State's database as reviewed in step 14.
12. Counts that are for less than a 48 hour monitoring period shall be based on some statistical analysis conducted by the State to determine that there is minimal variability in weekday counts concluding that 24 hour are just as accurate as 48 hour counts. The difficulty of counting, lack of resources for longer counts, or the ability to count more locations are not acceptable justifications for providing counts shorter than 48 hours. Counts less than 24 hours are not acceptable. Imputing missing hourly information is not acceptable for any count.
13. The frequency of counting shall be at least one third of all locations counted on a three year maximum cycle. If counts are older than three years then a recount or current year count is necessary unless the State has an alternate approved count cycle. Has this alternate approach been accepted by FHWA and reviewed recently to determine if it is still reasonable, documented, and acceptable. There may be locations with unusual volumes where this may be appropriate or where the data is obtained from sources such as freeway monitoring data, or other approved sources. Counts taken within three years shall be updated to reflect current year traffic using growth factors calculated by the State based on other count data as reviewed in step 13.
14. Growth factors shall be applied to all counts not counted in the current year so the AADT will reflect current year travel. Was the proper growth factor applied to the year the count was taken as verified from reviewing the State's table of annual growth factors? If the proper factor was not used or the number doesn't follow the trend from prior years or adjacent functional classes, then an in-depth review of the growth factor process should be conducted following the Process E Flowchart. If a proper growth factor was applied, then no other adjustments are necessary and you should proceed to step 9. The growth

factor process should be periodically reviewed at least every three years; assistance for this review is available from HPM30 (Traffic Monitoring Division) in the Office of Highway Policy Information. The State should be reviewing this process annually and updating at least every three years.

15. The traffic data reported in HPMS shall be the same data the State uses for their own purposes as contained in their traffic database. If this data is different, a review should be made as to why the difference and the need for a resubmittal of traffic data from the State's database may be necessary. Using the same data provides some assurance that it was collected and processed properly following the State's traffic monitoring program and not processed independently for HPMS. This also makes it easier to compare outputs from the HPMS submittal with the State's data, such as trends in VMT, if the same data is used.

Attachment F: Pavement Data Review Guidelines

The experience and expertise of the Division Pavement Specialists/Engineers should be utilized in conducting the pavement review. The review should focus on the State's Pavement Monitoring Program capability to provide quality and timely pavement data for State and Federal purposes. This includes the International Roughness Index (IRI), Pavement Serviceability Rating (PSR), Surface Type, Rutting, Cracking, Faulting data and other pavement related information as required in the HPMS Field Manual. The following issues should be examined:

Data Reporting

1. Is pavement roughness (IRI) data being collected on an annual cycle for highways designated as on the NHS, Other Freeways/Expressways, Other Principal Arterials and Minor Arterial Sample Sections. Is the 2-year maximum collection cycle for all other required sections being adhered to? If not, what update cycle is used and what are the State's plans for meeting the 1 or 2-year HPMS cycle requirement? When the last time pavement roughness (IRI) was collected? Is other required pavement data collected as a byproduct of the roughness data collection effort?
2. Is old (outside of guidelines) pavement data retained and reported until it is replaced by new data (it should be)?
3. Do all sample sections include IRI or PSR, Surface Type, Rutting, Cracking, and Faulting reported? (Required)
4. Is IRI reported on all NHS routes and principal arterials (i.e. NHS and FC =1, 2 or 3)? (Required)
5. Does the State report measured IRI only or is IRI converted from other data such as PSR?
 - a. How do you distinguish IRI from PSR on the report?
 - b. Are default or model conversion values used? (Not acceptable)
6. Is the pavement data reported in HPMS consistent with roughness data in the State's pavement management system? If not, why not?

Equipment

1. What kind of data collection equipment is being used to measure roughness, faulting and Cracking?
 - a. Direct Profilers (Preferred)
 - i. Direct Profile Measuring Equipment
 1. How many does the State possess?
 2. Does it contain a computer with sensors?
 - a. Two sensors separated approximately 63 to 71 inches
 - b. Longitudinal profile points used for calculating IRI have maximum longitudinal spacing of 5.9 inches
 - c. Contains long wavelength filters used to remove wavelengths exceeding 197 feet
 3. What type of sensors does it have?
 - a. Height sensor - Measures up and down movement of the van
 - b. Acceleration sensor - Detects changes in the speed of the van's up and down movement
 - c. Speed/Distance device - Measures how fast the van is traveling and how far it has traveled. Connected to a profiler's speedometer or to a wheel?
 - ii. Non contact Devices

Does it utilize laser, infrared, or ultrasound sensors?

- b. Manual Profilers (Discouraged from Use)
 - i. Manual techniques
 - ii. Rod and level or dipstick
 - iii. Used for calibration
 - c. Mechanical Roughness Meters (Allowed, but profilers more accurate)
 - d. Response Type Road Roughness Meters (Should not be used for HPMS)
Measure average rectified slope and converts into IRS Units.
 - e. Estimation (as reported in the HPMS Estimate Table)
Subjective estimations by observer using road description or ride sensitivities
3. What vehicle response variables does the State observe?
- a. Road Meter Response - For historical continuity, highly correlated to IRI
 - b. Vertical Passenger Acceleration - For ride quality, highly correlated to IRI
 - c. Tire Load - For vehicle controllability and safety, highly correlated to IRI
 - d. Vertical Passenger Position - Poor correlation with IRI
 - e. Axle Acceleration - Poor correlation with IRI
4. Is the equipment either Class 1 or Class 2?
Class 3 or Class 4 equipment should not be used.
5. What are the State's pavement data reporting equipment needs/wants?

Collection

1. Does the State use one or two technicians to measure roughness?
(2 is a good safety factor)
- a. One to drive - Focus on van's lane position, speed, safety
 - b. One to take readings - Finds landmarks, triggers the system, conducts quality control steps during measurements
2. Is pavement data filtered?
Is a quarter car or half simulation used?
3. Is the average of two wheel paths data reported? (Inside/outside)
4. Does the State use one direction for reporting pavement roughness in HPMS?
(Example: east to west or south to north)
- a. Does the State use the same direction each time pavement roughness data are collected?
 - b. Roughness should not be measured on both directions of roadway for HPMS. If both directions are collected, how are they used for HPMS reporting?
5. On multi-lane facilities, which lane(s) does the State use to collect roughness data?
For HPMS, it is required that the outside right lane be used and the same lane should be used each time pavement roughness data is collected.
6. Are bridges and railroad crossings excluded from pavement roughness data reported in HPMS?
- a. Bridges and railroad crossing pavement sections are required to be reported in HPMS

7. Are these conditions followed when measuring pavement roughness?
 - a. Pavement in stable condition
 - b. Good weather conditions
 - i. Wind conditions do not affect equipment stability
 - ii. Not during wet conditions
 - iii. Not during winter conditions - frost/freeze or freeze/thaw
 - c. Speed conditions specified by manufacturer, constant speeds within specified ranges
 - d. Minimum run-in length required prior to measurement, if not possible, is consistent.

Program

1. Does the State collect pavement data for off-state system roadways?
 - a. How is this data collected?
 - b. If collected by a contractor or other non-State agency, how does the State confirm the accuracy of data?
2. What State or local pavement management systems are there? Describe.
3. Does the State make IRI comparisons on asphalt vs. Portland cement concrete?
How does the State distinguish between the two pavement types?
4. How is roughness viewed?
 - a. Deviations in Elevation (Displacement Inputs)
 - b. Slope (Velocity Inputs)
 - c. Change of Slope (Acceleration Inputs)
5. What percent of NHS VMT in the State has an IRI below 95 and below 170 inches per mile?
 - a. Good (IRI<95) (national goal is 57% \geq good for 2009) Acceptable (IRI 95 to 170) Unacceptable (IRI>170)
 - b. What additional efforts or program changes are being made to meet this goal?
6. Do pavement roughness reports list all available information necessary to locate the section using agency's current referencing system?
 - a. Date of data collection (month/day/year)?
 - b. Length of section for which data is collected?
 - c. Profile sampling interval?
 - d. Long wavelength filter setting?
 - e. Pavement surface temperature (optional)?
7. Are the latest HPMS data collection requirements being met?
 - a. Is Rutting being captured and if so describe the methodology
 - b. Is Faulting being captured and if so describe the methodology
 - c. Is Cracking being captured and if so describe the methodology
 - d. If the latest pavement data items are not being captured, a plan must be prepared address these deficiencies.

Quality Assurance

1. Is pavement data verified in the field, especially where improvements are made?
 - a. Are temporary values used on pavement improvement sites until measured? How are they designated on reports?
 - b. How do you know where and when highway improvements are made?
2. Does the State adhere to AASHTO standards for pavement data collection?
3. Is there a quality assurance plan in place? The plan should include daily quality control equipment procedures (accelerometers & non-contact sensors), a schedule for accuracy checks of roughness

equipment, pavement roughness survey personnel training records, and a schedule for the regular calibration of roughness equipment.

- a. Are there verification sections?
- b. Are there quality checks?

References:

HPMS Field Manual, Chapter 5

University of Michigan Transportation Research Institute – International Roughness Index

National Cooperative Highway Research Report 228 Golden Car (on which IRI is based)

Attachment G: Sample Adequacy and Coverage Review Guidelines

The State's sample panel should have been randomly selected from roads in all geographic areas of the State. Over time both additions and deletions to the sample panel should also have been accomplished through a random selection process. The use of other than random sampling can introduce bias into the sample, and sample bias can adversely affect expanded sample travel estimates and other data applications relying on an expanded sample. With greater reliance on using the expanded sample for calculating travel and performance data, good sample management is an important consideration. The HPMS 8.0 software allows samples to be generated assuring that a random selection is made.

Active management of the sample is necessary to assure that the sample panel continues to represent the universe of public roads, to account for road system changes over time, and to account for the normal growth or decline of traffic volume. Sample management also allows the State to maintain a cost effective sample plan with neither too many nor too few samples.

The sample panel should be checked frequently to determine if there are a sufficient number of sections in each traffic volume group. This can be done using the sample adequacy routine in the HPMS submittal software. Adjustments to the sample should be made when necessary and can be done over time to reduce the reporting burden.

However, even if a State's sample panel is adequate, that does not mean that the sample data are adequate since the new HPMS data model makes each data item independent. The coverage of a sample data item may be measured as a percent of the sample panel that has data. For complete adequacy, the sample panel must be adequate and each sample data item must have 100% coverage.

Sample adequacy should be monitored continually however; an optimal time for more in-depth analysis is in the period immediately following the annual submittal. This permits any sample adjustments to be made in time to meet the next year's reporting date, and allows ample time to accomplish any additional data collection that might be needed for sample additions.

Some of the issues that could be examined include:

1. Has the State checked their sample adequacy to ensure that the number of samples per volume group meets the sampling requirements? Has the sample been updated when required?
2. How has the sample panel changed over the last 5 years?
3. Has the State adjusted the sample to reflect the adjusted urban boundaries? Is the State prepared to incorporate the 2010 census boundaries? Does the State have a plan to revise the sample panel based on these changes?
4. Are there any problems or issues in meeting sample adequacy requirements? Is the sample panel reviewed and updated on a periodic (3-year maximum) basis?
5. Are there unsampled, undersampled, or oversampled volume groups and what is the plan to address them? Has this plan been presented to the FHWA Division Office and to HPPI-20? Does the State use a random process or the HPMS software, considering all roadway sections both on and of the State system when selecting samples?
6. There should be at least three samples in each traffic volume group whenever possible. If the traffic volume groups are so small that there are not enough sections to meet the minimum criteria, there should be a review of the traffic data used to assign the sample sections to the traffic volume group to assure that

there is a real need for a separate group. If the review shows that a separate small volume group is needed, then all sections should be samples.

7. Are there volume groups that have expansion factors greater than 100.00? Additional sample sections should be selected from the universe until the expansion factor is reduced to a maximum of 100.
8. Is there evidence of possible sample bias in the sample panel? This can be determined by looking at a map of sample locations. It is more likely that sample bias may be a problem on the middle functional systems where the State owns fewer of the roads. Areas to review could include:
 - a. Are samples selected to have similar percent distribution of total mileage by functional system?
 - b. Are samples geographically concentrated in certain areas of the State or generally distributed between the various counties of the State?
 - c. Are samples clustered along selected routes or more widely dispersed?
9. What remedies are proposed to make up for any existing sample bias?
10. How does the State assign roadway sections to volume groups when it does not have actual, current traffic count information?
11. Are structures deleted from the sample where it is possible to do so? The State should eliminate samples that are entirely on a structure unless a volume group sample size requirement cannot be satisfied without including a structure-only section.
12. What steps has the State taken to identify and reduce the number of too-short sample sections?
When a sample section must be split as a result of boundary, functional system, traffic, or other significant roadway characteristic change (see HPMS Field Manual, page 6-12), the State may wish to eliminate the sample and select a new sample if a split would result in a sample section that does not meet the minimum sample length recommendations (see HPMS Field Manual, page 6-7).
13. Do sample breaks conform to the criteria in the table on page 6-13 of the HPMS Field Manual?
14. Does the State have a process for adding new roadway miles to the sample frame in a timely manner?

Background

The HPMS sample is a stratified random sample of physical roadway sections. The data provided through the HPMS relates to physical characteristics and operating conditions on each of the sampled roadway sections.

Samples are stratified as follows:

State – Rural/small urban/urbanized – Roadway functional system – Traffic volume group

All publicly owned roadway sections meeting the stratum criteria are eligible for selection as a sample on a random basis. The determination of the number of samples needed in each traffic volume group (the sampling rate) is based on the traffic volume (AADT) data item because of its high variability compared to other data items in the HPMS.

Samples are expanded based upon the ratio of total roadway miles in a traffic volume group to the total of sampled miles of roadway in that volume group.

The sample is considered a semi-fixed sample panel. Samples are generally fixed over time; however, they may migrate from one traffic volume group to another, usually because of reclassification of one of the

stratum criteria. Since traffic volume is a dynamic variable, sections most often move from one traffic volume group to another as a result of AADT growth. Samples also move when there are changes to their rural/urban characteristics as a result of census population changes, and when the functional class changes as land is developed and the traffic function of a roadway changes. Maintaining the sample panel requires the addition (and deletion) of samples over time to account for the shifts of existing sample sections between traffic volume groups.

As a result, active management of the sample panel is necessary to assure that the sample continues to represent the full extent of roads, to account for road system changes over time, and to account for the normal growth in traffic. Sample management also allows the State to maintain a cost effective sample plan with neither too many nor too few samples.

Sample Management Practices

There are a number of practices that should guide all sample management activities:

1. Since the sample panel is a stratified random sample, sample selections must be made on a random basis from all road sections that meet the stratum criteria. This applies whether new sections are being selected from the full extent for addition to the sample panel, or whether existing sample sections are being selected from a stratum for deletion.
2. Additional sampling criteria should not be applied when selecting sample sections. For example, the selection of samples should not be limited to State owned road sections only to the exclusion of roads owned by city or county governments.
3. The sample panel should be checked frequently to determine if there are a sufficient number of sections in each traffic volume group. Adjustments to the sample panel must be made on a random basis.
4. The best time to check sample adequacy is in the period immediately following the annual submittal. This permits any sample adjustments to be made in time to meet the next year's reporting date, and allows ample time to accomplish any additional data collection that might be needed for sample additions.
5. The sample also should be checked to assure that there are at least three samples in each traffic volume group whenever possible. If the traffic volume groups are so small that there are not enough sections to meet the minimum criteria, there should be a review of the traffic data used to assign the sample sections to the traffic volume group to assure that there is a real need for a separate group. If the review shows that a separate small volume group is needed, then all sections should be samples.
6. Attempts should be made to eliminate short sample sections. When a sample section must be split as a result of boundary, functional system, traffic, or other significant roadway characteristic change, the State may wish to eliminate the sample and select a new sample if a split would result in a sample section that does not meet the minimum sample length recommendations (see *HPMS Field Manual*).
7. Generally, existing samples should not be split for reasons other than those reflected in the *HPMS Field Manual*.
8. If the expansion factor for a volume group is more than 100, additional sample sections should be selected from the full extent volume group until the expansion factor is reduced to a maximum of 100.

Sample Bias

Samples usually become biased when the State violates the random selection rule or imposes other criteria on the sample selection process. Some activities that result in sample bias include:

1. Selecting only State-owned road sections for sample panel;
2. Selecting as a sample a section adjacent to an existing sample because it is easier to code the same data;
3. Selecting as a sample a road section in a specific county or highway district because it is convenient for State staff to access and inventory the section; and,
4. Applying other external criteria or conditions to the sample selection process that violate the random selection rule.

Existing samples may be biased because the State did not apply a random selection process to the original sample. However, as a result of poor sample management practices, even a sample initially selected on a random basis may become biased if samples are added or deleted on other than a random basis over time.

In general, biased samples are best corrected by randomly selecting an entirely new sample. An alternative the State may consider to remedy past bias is to make any further sample adjustments on a random basis; over time, this should lead to a more unbiased sample. Also, the State may consider making specific adjustments to a sample to eliminate bias directly by adding samples in such a way that the effects of the bias are negated. This last process is somewhat complex in that the bias identification, sample analysis, and sample adjustment must be carried out at the traffic volume group level.

For instance, to determine if a rural major collector traffic volume group is biased to State ownership, it would be necessary to look at the ownership of miles in that particular traffic volume group, both full extent and sample. If the sample reflects the inclusion of both State and non-state owned miles, and the representation in the sample and full extent are reasonably similar, it is likely that the sample was chosen in an unbiased manner.

While this may be obvious if there is a substantial representation of both types of ownership in the sample as well as in the full extent, it may be less than clear where the full extent contains very few miles of either ownership type. A full extent comprised of 90% State owned roads could easily yield a sample containing only State owned roads as a result of random selection. On the basis of probability, a full extent comprised of 80% State owned roads could be expected to have between 1 and 3 non-State owned samples out of every 10 as a result of random selection. The best way to determine bias, however, is to know that the State engaged in a biased, non-random, selection process.

If an adjustment to a sample with a clear State owned road bias is necessary, it only should be made at the volume group level. An appropriate adjustment could consist of randomly adding non-State owned road sections to the sample and randomly deleting the same number of State owned road sections until the number of State and non-State owned road sections had similar representation in both the full extent and sample for that particular traffic volume group. This would keep the total number of samples, and hence the sampling rate, the same. This kind of adjustment should not be done routinely and should be considered only where there is clear evidence that a sample has indeed been biased by the use of improper sampling practices.

Sample Management Reviews

A periodic sample management review should be done in cooperation with the State HPMS counterpart. As part of the review of the State's sample management activities, FHWA needs to be able to determine the following:

1. Does the State annually run the sample adequacy software after the HPMS submittal to determine if an adjustment to the sample plan is needed for the next year's data? To be most effective, this should be done immediately after that data are submitted so as to allow the remainder of the calendar year to be used for making any necessary sample adjustments.
2. Are adjustments to the sample made on a random basis as a result of the adequacy check?
3. Are all public roads on the sampled functional systems included in the pool of full extent sections from which new samples are drawn, regardless of ownership?
4. Is there evidence of sample bias, such as sample clustering on a facility, or within a county, or within a highway district, or is the sample reasonably distributed? This can be determined by looking at a map of sample locations.
5. Is there sample bias based on State and non-State roads? This comparison needs to be made by volume group within each functional class.
6. Has the State engaged in practices that can result in sample bias in the past? How and where did it occur? Are biased practices still in use? What changes have been made? It is more likely that sample bias may be a problem on the middle functional systems where the State owns fewer of the roads.
7. What remedies are proposed to make up for any existing sample bias?
8. What steps has the State taken to identify and reduce the number of too-short sample sections?
9. Are there volume groups that have expansion factors greater than 100?
10. Has the State adjusted the sample to reflect the latest Census urban boundaries; does the State have a plan to revise the HPMS sample based on these changes?
11. Does the State have a process for adding new roadway miles to the HPMS full extent in a timely manner?
12. Are there unsampled and undersampled volume groups and what is the plan to address them?

References:

[HPMS Field Manual, Chapter 6](#)

[HPMS Sample Management](#)

Attachment H: Geographical Information System (GIS)/ Linear Referencing System (LRS) Reviews

1. Is their GIS data in real or near real time when reflecting the DOT's enterprise data?
2. Is it a transportation backbone for the entire State, i.e. part of a comprehensive Statewide Geospatial program?
3. Is the DOT's GIS section a traditional GIS workgroup bringing in external data to process or is it fully incorporated with the enterprise (relates to question 1).
4. Does it match and is it completely current with HPMS, i.e. did it clear the HPMS validations.

5. Is the GIS program well funded i.e. are they fully utilizing SPR?
6. Is the GIS program growing utilizing new technologies such as 3D LRS, Multi-Level LRS, Geospatial Databases etc.
7. Is the GIS program vendor neutral, i.e. do they use the best software for the job?
8. Can the GIS/LRS data be migrated to different platforms easily?
9. How does the state collect Geospatial Linear data off of the State Highway System? Fed-Aid System (Local Roads)?
10. Is the DOT executive management aware of the GIS/LRS and the importance to the overall Transportation Community?
11. Is the GIS fully engaged with the State's GIO (NSGIC representative)? Relates to Q2.